

SCIENCE.

FRIDAY, JUNE 18, 1886.

COMMENT AND CRITICISM.

THE INCREASED ATTENTION which is at present directed to artificial butter and its mixtures with dairy butter, and which has been aroused by the attempt of the dairy interest to secure national legislation to restrict the manufacture of oleo-margarine and similar substances, makes a recent report of the Imperial health office at Berlin of great interest to the scientific and general public. The inquiry was undertaken at the demand of the government for the discovery of a butter substitute which should, through its cheapness and better keeping-qualities, prove desirable for the navy and the poorer classes. From a sanitary point of view, the report considers that the butter substitutes found in the market are harmless. In all the factories investigated the great cleanliness and care used seemed to make the manufactured article more appetizing than many dairy butters. It is, however, granted, that, when improperly prepared from fats of uncertain or unhealthy origin, there may be danger of the communication of disease: and it is not always possible to tell whether a fat is from a healthy source or not. Disease, it is true, may be communicated through the milk of an infected animal, but such a condition in a living animal is more readily detected. As the production of oleo-oil increases, the demand will exceed the supply, and compel the use of fat from doubtful sources. This, perhaps, already occurs in some cases. There are records of the discovery of bacteria and parasites in some butter substitutes, and the question arises whether the heat used at any time during the process of manufacture is sufficient to kill them. Low temperatures are the rule in most factories, and it appears that the possibility of injury to health from this source is not excluded. The substitutes can also contain ingredients which may prove injurious by loading down the intestines with material of no nutritive value. Soapstone-powder has been thus used for the purpose of giving butter additional weight. Coloring is only objectionable when poisonous dyes are used, but the same objections apply to the coloring of dairy butters as of substitutes. Aside from

these injurious contaminations, the question of the sanitary quality of artificial butters must be decided by their relative nutritive value and digestibility as compared with the natural articles. This question, the report considers, is not yet settled from a scientific stand-point.

The conclusions derived from the investigations of this subject are stated as follows: "1. Artificial butter prepared from the fat of healthy animals, aside from a perhaps somewhat smaller digestibility in comparison with milk-butter, furnishes no occasion for the acceptance that it can act injuriously on human health; 2. It is possible that a part of the artificial butter found in the trade is prepared from such material, and by such methods of manufacture, as would not exclude, with certainty, the danger of the communication to human beings of diseases which can be produced by vegetable organisms or by animal parasites; 3. It is possible that some artificial butter is prepared from nauseous materials." It is therefore necessary that there should be strict regulation of the commerce in this article, although at present the means of bringing this about are doubtful. The methods of distinguishing between natural and artificial butters are reviewed at great length as being the basis upon which any regulation of the industry must be founded. The perfection of the recent processes of manufacture are such that these substances cannot, in most cases, be distinguished from each other by their external appearance, or by the senses in any way, without the aid of physical or chemical investigation. Of the physical methods which have been commonly applied, the report refers to those depending on the determination of the melting-points of the various fats, the specific gravity at certain temperatures, the appearance under the microscope, the examination with the refractometer, and a new method of Professor Mayer's. Almost all of these are considered to be of value only within certain narrow limits, as mixtures of fats and oils are found which correspond closely to pure butter. For the practical dairyman, the determination with the areometer, of the specific gravity of the fat melted at 100° C., is regarded as the most available test. While the test is not entirely satisfactory, and cannot com-

pare with those of a chemical character, it is apparently the only one which is available for use outside the laboratory. The differences in the specific gravities of different fats, which furnish the basis for distinguishing them, seem to be hardly great enough to detect mixtures of small amounts of oleo fat or oils with dairy butter.

THE REPORTS that announced the suicide of the King of Bavaria, at the same time brought the news of a sad loss to science. The physician of the king, Dr. Gudden, who lost his life in the attempt to save that of his charge, was one of the most noted authorities in the sphere of nervous and mental diseases. He has also been at the head of a laboratory in which investigations of the fine anatomy of the brain, spinal cord, and sense-organs have been carried on. He has given his name to a matter of studying the connections of the nervous system which is as ingenious as it has proved fruitful of results. Gudden's method consists in extirpating a sense-organ or other part of an animal when young, and then allowing the animal to grow up. At death the animal is examined, and the fibres which have failed to develop will thus be marked out as the paths of connection between the extirpated sense-organ and the brain-centre. For many years Dr. Gudden has been working at the problem, What is the mode of connection between the retina and the brain? His results are not yet before the public, but the great care and patience which always characterize his work will surely make them valuable. His loss in this difficult department of anatomy and pathology is a very serious one indeed.

ASPECTS OF THE ECONOMIC DISCUSSION.

WITHIN the past two months *Science* has contained three extended articles, in which, in compliance with the invitation of the editor, several distinguished members of the so-called 'new school' of economists have undertaken to set forth their principles. In compliance with a like invitation, I now present my views upon the aspect which the discussion has assumed.

If I rightly understand the case, the primary object of the discussion was to afford the representatives of the new school an opportunity to set forth such peculiarities of their tenets as might justify the appellation which they claim, and at the same time afford the student an opportunity to compare their principles with those of the school from which they are supposed to diverge.

The main point in which the new school is supposed to differ from the other, is that it looks with more favor upon government intervention in the processes of industry and trade; and it might naturally have been expected that its representatives would define their position upon the questions here involved.

In this respect the outcome of the discussion is disappointing. After a careful study of the three papers already published, which bear directly on the subject, I am unable to form any clear conception of the ground taken by the writers on these fundamental questions. The form in which the question first presents itself to my mind is this: the familiar terms 'government intervention' and 'state interference' are themselves so vague, that in discussing them we must exactly define the sense we attach to them. There are two or three forms of state intervention. And it may be that one form is good, and another bad; that one form will inevitably tend to increase with the progress of society, and another to diminish. Again, we must draw a distinction between intervention in purely economic affairs for purely economic objects, and intervention for other and wider purposes, such as the promotion of education, the public morals, and the public health.

These definitions would only have been preliminary to the main object, which is to define to what extent state intervention can with advantage be carried. There can be no reasonable discussion over such vague propositions as, 'the state ought to interfere,' or 'the state ought not to interfere,' because every one is agreed that the state ought to interfere where it is really necessary to the public welfare, and that it ought not to interfere when it will not promote the public welfare by so doing. Again, when the state does intervene, it must intervene in the right way; and the question whether any particular way is or is not the right one must remain open until it is examined. The careful reader of the discussion will see that no progress whatever is made, in the articles alluded to, towards answering these fundamental questions: I am therefore obliged to consider in a general way such of the points brought forward as seem worthy of comment.

Professor Seligman's paper, on the changeable character of the tenets of political economy from age to age, seems to me a very admirable one. It shows very clearly the relations of economic theory to economic practice at various epochs in the world's history. It implies that the orthodox economic principles of the first half of the present century must pass away, as others have done, with changes in the forms of industry. While I heartily agree with nearly all that he says, when I am

allowed to interpret it in my own way, I yet fancy that I see in it an undercurrent of thought which conveys a false implication. Possibly I may make myself clearer by being allowed to intrude my own views of the abstract or so-called English political economy of the past generation. They may briefly be summed up in two propositions : —

First, this economic system has become entirely insufficient to satisfy the progress of the age, and does not furnish us the means of solving the new problems which now confront us.

Second, this same system is a most necessary part of sound economic teaching, and embodies the principles which the public now most need to understand.

If the reader now sees any thing contradictory in these two propositions, I beg him to compare the following illustrations of their relation. I have a carefully built roadway from my house to a city five miles away, part of which comprises costly bridges over streams and ravines. In the course of events the city is moved five miles farther on, so that my road only carries me half-way to it. I can now say of the old road just what I have said of abstract or mathematical economy, that it is totally insufficient for my purpose, and yet is most necessary to enable me to reach the city. My wise course is not to tear down the road as useless, but simply to extend it farther on. If I employ men to build the extension, and at the same time denounce the old road as a nuisance in such strong terms, that, on going out next morning, I find my men have blown up all the costly bridges in obedience to my supposed wish, I will have made a great mistake. The fact is, I do not want a new road, but an extension of the old one to suit the changed conditions.

Professor Seligman says that we are compelled to regard much that was at the time probably correct and feasible, as to-day positively erroneous and misleading. Now, I regard this statement as itself misleading, being true or false according to the way in which it is understood, and as more likely to be understood in a false sense. Whether such doctrines as we meet with in economics will prove feasible or misleading depends upon the way we interpret and apply them rather than upon the doctrines themselves. The doctrine that a straight line is the shortest distance between two points is, abstractly considered, always true. It teaches us, that, other conditions being equal, a straight road between two points is the easiest. If we apply it to cases in which the different roads we may take to our destination are all alike except in their directness, we shall apply it correctly. But if, blindly following it, we pursue a perfectly straight road which is very bad and rough, in preference

to a crooked one which is hard and smooth, we shall make a great mistake. Are we, then, to denounce the doctrine as false and misleading? If we did, we should only act on the same principles upon which three-fourths of the critics of the older political economy act. Considered in the concrete, every general proposition is true or false according to the circumstances. Practical wisdom consists in selecting such propositions as apply to the case in hand. It seems to me that abstract English political economy, as I find it in the textbooks, contains a number of great and valuable truths applicable to the present state of society, mixed with a quantity of matter which can be made useful only by reconstruction. In the latter category I include the leading propositions about profits, wages, demand for labor, the wage-fund, and the functions of a paper currency. In a word, economic principles should be looked upon as the tools of trade of the economist, to be used as occasion offers to make them useful.

Professor Ely's paper opens with a most timely exposition of the necessity that disputants should begin by understanding each other's position. I have often suspected disputants of deeming it highly impolitic to define their position on the points under discussion, because, when they do so, they have to stand there to be fired at, while by refraining from it they can step around briskly in such a way as to dodge all the enemy's shots. Professor Ely goes on to take exception to the statement that economic science should not concern itself with what ought to be. The question here raised is one which we can decide either way with equal correctness, according to the view we are to take of the scope of science. If we confine the word 'science' to what I think should be its proper scope, it is a contradiction in terms to call a talk about what ought to be, science. In the proper sense of the term, science consists of exact and systematized general knowledge; and the great difficulty with Professor Ely's extension is, that it tends to increase the prevailing confusion in men's minds between talk about things as they are, and about things as we would like them to be. I see no more logical objection to building up a science of political economy which shall be wholly concerned with things as they are, especially with the relations of cause and effect in the commercial world, than I do to getting up a guide-book showing how long it takes different ships to cross the Atlantic. On the other hand, I would no more consider this the end of the matter than I would consider the guide-book as the only one the tourist should read. The economic student is no doubt very much interested in what ought to be, and, in

fact, this may be the object of all his economic studies.

Why, then, should we not allow the economic student to consider things as they are, and things as they ought to be, altogether? I reply, the reason is that he is thus led into a confusion of thought which is fatal to his success. I find that men continually think we are talking to them of things that ought to be, when, in fact, we are only talking of things that are or would be. Indeed, from what little I have seen of men and their ways of reasoning, I am inclined to think that one of the most difficult pieces of mental discipline is that of learning to look upon facts simply as facts. Times without number I have seen educated men refuse to accept a statement of fact, not on the ground that it was not a fact, but that it was not *necessarily so*, or *might* be different, or *ought* to be different. I should be very sorry to see any teacher foster this mental weakness; and I see no way to cure it except to say to the student, 'Now, remember that I am only telling you facts and results.'

Passing on to what ought to be, Professor Ely sets forth in detail the ethical idea which animates the new political economy. He thinks that economists, like everybody else, should strive after perfection. In this I do not think he will find any to disagree with him. When he tells us what we are to do to bring about the rational perfection which he is aiming at, there may be differences of opinion; but, when he thinks that he sees any great divergence between his views and the popular ones which he cites, I cannot but think he is mistaken. For example: he tells you, that, if you listen to two ladies discussing the education of the serving-class, you will find that the arguments all turn upon the effect thereby produced upon them as servants. But is it not highly probable, that, taking these people as they stand, their development into good servants is the highest and most rational of which they are capable? Would he have Cuffee trained into a novelist, a chemist, or a metaphysician? Is it not highly probable that that being does more good, both to himself and to society, by being a thoroughly good servant than he would by being the very best mathematician which he was capable of being? If so, then there is no antagonism between the selfish housewife and the philanthropic professor.

Again, he cites Renan as calmly assuring us that forty millions may well be regarded as dung did they but supply the fertility which will produce one truly great man. It seems to me that this remark is too figurative to base any discussion upon. It indicates no definite policy towards the

lower classes, and only gives voice to the feeling that one great man may be more important than millions of the lower orders of men.

It seems to me these remarks of Professor Ely savor much more strongly of the doctrines of individualism, which he vigorously opposes, than of those of the socialistic school of which he is so distinguished an expounder. If I rightly understand the ground taken by the last-named school, it is that the interests of the individual should be held subordinate to those of society, and that the prosperity of society should be the first object of the economist. Accepting this view, it follows that the education of the masses should be directed by considerations based less upon the wants of their members as individuals than upon the wants of society at large, future as well as present. If, now and during the next hundred years, society stands more in need of great leaders of thought, administrators, and expounders, than it does of servants and mechanics, it follows, from the socialistic point of view, that our efforts should be directed to the rearing of such men rather than to the education of the masses in subjects that will not make them better citizens.

One would infer from Professor Ely's paper that a very serious question at issue between himself and the older school of economists is whether ethical considerations should be allowed to obtrude themselves into questions of economic policy. I think a careful review of the ground taken by the new school will show that it is his school which is most prone to reject such considerations. For example: in the case of free trade it is very common for representatives of the school of governmental interference to claim that freedom of trade is founded on the idea that the interests of humanity at large should be taken into account in deciding the question. In opposition to this, they claim that we should consider our own interests exclusively. Again: the claim that every individual has the right to be the sole master of his own acts, within the limitations necessary to social order, is a purely ethical one; yet no doctrine of the old school is more vigorously assaulted by the new school.

The fact is that Professor Ely, in the following passage, gives an admirable statement of the doctrine of the school of individualism, to which he professes a bitter opposition:—

"It is well to describe somewhat more in detail the ethical ideal which animates the new political economy. It is the most perfect development of all human faculties in each individual, which can be attained. There are powers in every human being capable of cultivation; and each person, it may be said, accomplishes his end when these

powers have attained the largest growth which is possible to them. This means any thing rather than equality. It means the richest diversity for differentiation accompanies development. It is simply the Christian doctrine of talents committed to men, all to be improved, whether the individual gift be one talent, two, five, or ten talents. The categorical imperative of duty enforces upon each rational being perfection after his kind."

The school of non-interference claims, that, as a general rule, these ends are best attained by giving the adult individual the widest liberty within the limits prescribed by considerations of public health and morality.

After following the discussion so far upon the lines it has already taken, I deem it right to bring out in strong relief what is the real gist of the question. What advocates of non-intervention by government base their policy upon, is neither an abstract theory of society, nor a system of ethics, but a practical business view of things. As matters now stand, government ought not to interfere, for the simple reason that the policy and acts to which it would be led are not founded on sound business principles. I have myself been a careful student of the treatment of economic questions in congress during the past thirty years; and the general outcome of all I have seen is, that, leaving out legislation on well-marked lines for the supply of obvious public necessities, no really wise economic legislation by congress is attainable. Congress is not, and in our time cannot become, a body of investigators or theorists. Within a certain field I regard congress as an excellent representative of the wisdom of the nation; but it goes outside of that field when it considers economic theories. It then becomes the representative of the time-honored fallacies of the people rather than of their wisdom. If any one doubts this, he has only to look upon a few shining examples now before us.

The nation at large looks with regret upon the decline of American shipping, which has been going on ever since the civil war, and earnestly desires that we should have a mercantile fleet sailing the ocean under the American flag. Now, what measures have our legislators taken to bring about this result? They are in their main features as follows:—

First, that no American owner of a ship shall be allowed to sail her under the American flag unless she was built in the United States.

Second, that no person shall be allowed to build a ship within the United States unless he pays a heavy penalty, called customs duty, on all the machinery and raw material which he may find it advantageous or necessary to import for the pur-

pose. In the case of a large ship-yard, this penalty may amount to hundreds of thousands if not a million of dollars. Possibly no one in the United States would make the machinery on any terms whatever, and possibly some of the material may be monopolized by a single company or combination; but the penalty is exacted without regard to circumstances.

Third, that, after the ship is built, its running shall be subject to certain restrictions, of so onerous a character, that after paying all the penalties, and going to all the labor of building the ship, the owner will run her at a loss when he could make a profit by sailing her under a foreign flag.

In brief, our legislation has thrown positive obstructions in the way of any ship being run under the American flag. The only remedy that the promoters of this legislation have offered us is that of hiring American shippers by heavy subsidies to overcome the obstacles which we have thrown in their way. Everybody who chooses to look into the subject can see that, in order to secure an American mercantile marine, all we have to do is to repeal all laws throwing obstructions in the way of Americans building, owning, and sailing ships, thus allowing every American citizen to get his ship where he pleases, to build her as he pleases without interference from customs authorities, and to sail her without vexatious regulations.

The proof of this is afforded by the fact of ownership of foreign lines by American companies at the present time. For example: the well-known Red Star line between New York and Antwerp, which the reader constantly sees advertised in the New York papers as sailing under the Belgian flag, is really owned and managed by an American company. This company calls its ships *Belgian*, and sails them under the Belgian flag, simply because our laws do not allow them to sail under the American flag. The same thing is partially true of the well-known Inman line between New York and Liverpool, and, to a less extent, of the Guion line. I cannot speak accurately on the subject of these last two lines, but my impression is that American enterprise is gradually getting possession of them.

I wish very much *Science* would induce our new school of economists to give their frank opinion of this policy. They might at the same time tell us what they think of the economic soundness of the principles on which the oleomargarine bill was sustained. I refer more particularly to the doctrine that it would be a great public calamity if the public of this country were allowed to get their butter for seven cents a pound, because then all the dairies would have to stop business. The total failure of congress not only to remedy the

present anomalous condition of the silver coinage, but even to take any rational measures for finding out what ought to be done in the case, is another subject on which their views would be of interest. I cannot help thinking, if they would grapple with these practical difficulties, and tell us what wise and good legislation they expect to get through congress, they would be more effective than they are in confining themselves to discussions on which no effective issue can be joined.

S. NEWCOMB.

FLOODING THE SAHARA.

MUCH misinformation has of late been spread abroad respecting 'the proposed interior sea of Africa,' and the public has been misled by inaccurate statements in regard to the magnitude of the enterprise, which, it is assumed, the French people are about to undertake. For these current erroneous impressions the English and American scientific journals are largely to blame. An old theory regarding the Sahara — that it was for the most part below the level of the ocean — has been adopted as though modern surveys had not refuted it; and so the conversion of a material portion of the African continent into a navigable sea is being popularly considered as not only possible, but altogether likely to be accomplished.

A brief consideration of the published results of the recent surveys will be sufficient to convince the reader that the popular estimate of the magnitude of this enterprise is absurdly out of proportion to the greatest possible accomplishment.

This overestimate is not surprising when we consider the character of the references to the scheme which have been made by journals of the best standing. The following paragraph from the foremost among engineering journals may be taken as a sample: —

"With reference to the daring French project for flooding the desert of Sahara with what would be virtually a new sea, it may be well to recall the opinion expressed by M. Elisée Réclus, that at one period in the world's history the desert was covered by a sea very similar to the Mediterranean, and that this sea exercised a very great influence upon the temperature of France, as comparatively cold — or, at any rate, cool — winds blew over it, while now the winds which prevail in the great expanse are of a much higher temperature, and are, in fact, sometimes suffocatingly hot. The appearance of the desert seems to support the theory of M. Elisée Réclus, that it was at one time the bed of a sea of considerable extent, of which the great inland African lakes recently discovered are possibly the remains. The present

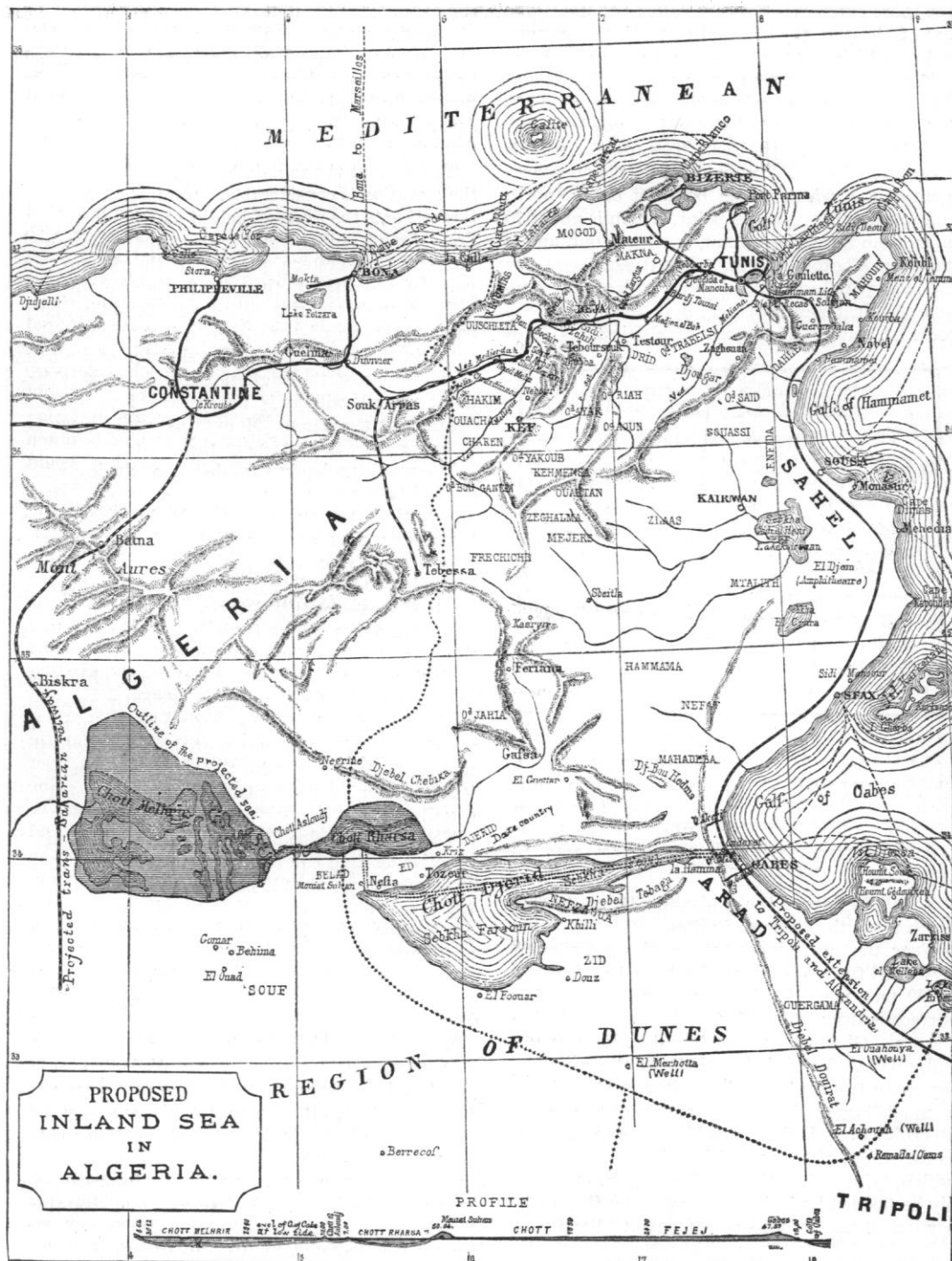
vast extent and configuration of the African continent would also appear to support the conclusion that at one time it comprised a less area of land than it does at present. The serious question which arises, assuming that the theory of M. Elisée Réclus is substantially correct, is, What will be the effect of the creation of a second African sea in the room of that which has disappeared? Would the temperature of France, and possibly even of England, be again reduced? It is a geological theory that in the glacial period of the world's history Great Britain was covered with ice and snow very much as Greenland is at present. Some great influences must clearly have been brought to bear upon France and Great Britain, which rolled the ice over so many hundred miles northward. What was this influence? Was it the large African sea which French enterprise is endeavoring to recreate? If it were, we should say that whatever the French may gain in Africa by the realization of a Saharan Sea would be much more than counterbalanced by what they would lose in France itself."

A writer in another journal suggests that all nations interested in the commerce of the Mediterranean may by right protest against the execution of a scheme that would produce a troublesome current through the Straits of Gibraltar. And the same writer, furthermore, adds, "So much water drawn from the present oceans, may, by lessening the depths of the harbors of the world, produce serious and wide-spread inconvenience."

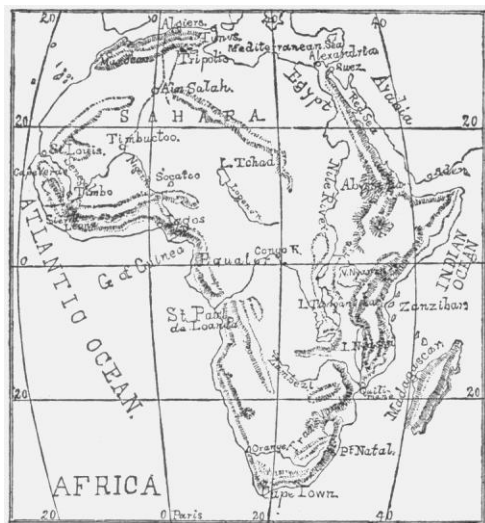
That all such fears are utterly groundless is abundantly shown by the results of the careful surveys made within the last few years. A brief *résumé* of these results is presented below. The figures are reduced from the metric measures in 'Nouvelle géographie universelle,' by Réclus, and the maps from 'Le génie civil.' In both cases the authority quoted is the French engineer, M. Rou-daire.

Every one who, as a student, has had to draw the map of Africa, can certainly recall that singular interruption to the otherwise regular coast-line on the extreme northern boundary, where the coast, for a comparatively short distance, has a general north and south trend. This notch marks the north-eastern terminus of the Atlas mountain system. The eastern shore is the eastern boundary of Tunis; and on it, in ancient times, stood Carthage. An indentation at the southern part is called the Gulf of Gabès.

A line extending due west from the shore of this gulf crosses a barren region, of no interest but for the project about which this article is written. It is a region abounding in basin-shaped depressions, containing either shallow salt-marshes,



brackish pools, or deposits of salt and gypsum. The more extensive areas are called 'chotts.' The first of these is the Chott-el-Fedjedj, the eastern end of which is 12 miles from the shore of the gulf, and separated from it by a ridge of drift and limestone whose altitude at the lowest point is 150 feet. The surface of el-Fedjedj is nowhere less than 48 feet above the sea. Toward the west it is contracted in width somewhat by the encroachment of the ridges which bound it on the north and south. Beyond this point, which is about 70 miles from its eastern limit, it widens out, and is known as Chott-el-Djerid. Here the surface is for the most part level, and covered with an incrustation of salt, beneath which, in a few places, are pools of water. The plain of el-Djerid is from



MAP OF AFRICA, SHOWING THE RELATIVE SIZE OF THE PROPOSED INLAND SEAS.

50 to 200 feet above the sea-level. Its width from north to south is about 45 miles.

Near the north-west border of el-Djerid, and separated from it by a ridge whose least altitude is 550 feet, is the Chott Gharsa or Rharsa, whose surface is from 30 to 35 feet below the level of the sea. Gharsa is about 50 miles long and 20 miles wide. Beyond this chott to the west, and separated from it by an insignificant elevation, is a much larger depressed area, known as Chott Melghigh or Melhrie. This is the basin referred to as the site of the proposed interior sea. The area which, lying below the Mediterranean, can possibly be flooded by it, is represented by the shaded portion on the accompanying maps.¹ Portions of

¹ The scale of the larger map is about 58 miles to the inch.

this area are 100 feet below the sea-level; and the average depth, if flooded, would be 78 feet.

The figures above given exhibit the possible dimensions of the 'flooded Sahara.' The united areas of the two chotts over which the sea would flow is, by Roudaire's measurements, about 3,100 square miles, less than half the area of Lake Ontario.

Throughout the remainder of the Great Desert the elevation is considerable. Competent authorities estimate the average height at 1,100 feet. Dr. Lenz found, in travelling over many hundred miles of the western portion of the Sahara, no point of less altitude than 470 feet above the sea.

The fact that marine deposits are found in many parts of this area is, of course, a fact of no significance in this connection. The skeleton of a whale found in one of the highest cuttings of the Vermont central railway is not regarded as an evidence that the Green Mountains could now be submerged by the waters of the ocean.

The whale probably stranded there during what geologists term the 'Champlain epoch,' since which time the surface has slowly risen. The hypothesis that at least eighty thousand years have elapsed since this epoch is believed by most geologists to be well founded. Explorations across the African desert justify the belief that the marine deposits found there are not less ancient than those of the Champlain period.

To flood such a section with the sea, either the next great subsidence must be patiently awaited, or else an extensive system of pumping must be resorted to. The realization of the scheme of submergence (to accord with the popular estimate of it), by either of these plans, may be regarded as equally remote.

The project of flooding the Sahara to the utmost practicable limit can hardly be called a great one. It is safe to say, that if executed, which is doubtful, it will not sensibly affect the climate of southern Europe. It will not create dangerous currents at Gibraltar, nor inconvenience seaports in any part of the world. GEO. W. PLYMPTON.

LONDON LETTER.

A SUGGESTIVE report by Mr. W. H. Power, of the Local government board, has just been published, relative to the connection between scarlet fever and infected milk, — a connection which has long been suspected. The farm in question was sanitarily perfect, every modern improvement in respect to cleanliness of vessels, and examination of persons employed, being in force. Mr. Power was assisted in his investigation by Dr. Klein; and their joint results leave little or no

doubt that the cows of the dairy were infected with a specific disease of a constitutional character, whose local manifestations were external sores on the animals, and that the milk from these cows was capable of imparting scarlatina to human beings, and was the real cause of an epidemic of scarlatina in a large district (Marylebone) in London. Two of these animals were purchased for the Brown institution (established in connection with the University of London for the investigation of animal pathology); and the exact nature of the diseased milk is still being inquired into by Dr. Klein.

The ensilage commissioners have just issued their complete parliamentary report, one of the most valuable documents ever put into the hands of the English farmer. They have gone about their work in a thoroughly judicial spirit, and the result of their inquiry is to establish the use of the silo as an essential part of the procedure of successful agriculture. Green forage well preserved in a silo is, weight for weight, one-third of the same forage made into hay; but, as the weight of the most perfect silage is five times that of the hay, it is sixty per cent more valuable. The full conclusion of the commissioners can best be expressed in their own words: "After summing up the mass of evidence which has reached us, we can without hesitation affirm that it has been abundantly and conclusively proved to our satisfaction that this system of preserving green-fodder crops promises great advantages to the practical farmer, and, if carried out with a reasonable amount of care and efficiency, should not only provide him with the means of insuring himself to a great extent against unfavorable seasons, and of materially improving the quantity and quality of his dairy produce, but should also enable him to increase appreciably the number of live-stock that can be profitably kept upon any given acreage, whether of pasture or arable land, and proportionately the amount of manure available to fertilize it."

The deputy master of the mint has just issued his report for 1885, a document of much interest. The coinages required by the English colonies were more numerous than, and exceeded by £85,000 in amount, those of any previous year. This is attributed in great measure to the depression in the West Indies. The balance of receipts over expenditures was more than £70,000, one of the expenses being the preparation of medals for troops engaged in suppressing the Canadian rebellion. Mr. Fremantle reports, that "although during the year 1885 a considerable amount of coinage has been executed in the British and United States mints, and in those of some European nations,

hardly any addition has been made in several countries, and notably in France and Germany, to the metallic currency of the world;" and also that "the questions connected with coinage, which have of late years been discussed with the greatest interest, have not made any appreciable progress toward solution."

A large private electric-lighting installation has just been inaugurated at the London terminus of the Great western railway. The whole district lighted is $1\frac{1}{2}$ miles long, and covers 67 acres of ground; 4,115 glow-lamps of 25 candle-power each are used, 93 arc-lamps of 3,500 candle-power, and 2 arc-lamps of 12,000 candle-power. The two dynamos employed are those of Mr. J. E. H. Gordon, and weigh 45 tons each, one-half of which is due to the ten-foot revolving magnet wheel, which runs at 146 revolutions per minute. The electromotive force is 150 volts. The mains are all underground, and the glow-lamps are all in parallel arc. Two lines of steam-pipe supply the engines, and a third dynamo is kept in reserve. The Telegraph construction and maintenance company have contracted with the railway company to work it for three years.

At the last meeting for this season, of the Society of telegraph engineers, etc., about thirty-five candidates were elected into the society. There was an interesting discussion, in which Dr. Jacques, electrician to the Bell telephone company, U.S.A., took part, on the use of the telephone as a receiving-instrument for Morse signals in warfare, and on the general military question of recording *versus* non-recording receiving-instruments.

In continuation of brief comments upon exceptional weather in Britain, which have appeared in this correspondence, it may here be mentioned that from May 11 to May 15 the mean temperature was from 6° to 8° below the average; and that torrents of rain fell over a very wide district, more than four inches in three days (11th, 12th, and 13th) being not uncommon. The valleys of the Severn and Trent suffered severely, railway traffic being suspended, and many inhabitants driven from their homes. Severe tornadoes occurred at Madrid, Krossen, Linz, and other European towns, two or three days after those in Kansas City and other parts of the states.

English pathology has suffered a severe loss by the death, at the early age of forty-five, of Surgeon-Major T. R. Lewis, the assistant professor of pathology at the Army medical school. He had made a special study of microscopic organisms and their relations to disease, and was the author of several most valuable reports to the government of India on cholera and the fungus disease of India. In the autumn of 1884 he visited Mar-

seilles, where cholera was then prevalent, for the purpose of investigating the results obtained by Dr. R. Koch and the other members of the German cholera commission in Egypt and India; and he arrived at the conclusion, which is now widely accepted, that the selection of the comma-shaped bacilli as the *materies morbi* of cholera appears to be entirely arbitrary, for he found that these comma-shaped bacilli are ordinarily present in the mouths of perfectly healthy persons.

The value of Professor Lewis's biological work was recognized by the council of the Royal society when they selected him, in April last, as one of the fifteen candidates to be recommended to the society for election in June; and his death thus leaves a vacancy in the list, which it is said the council will now fill up by the selection of Mr. A. Sedgwick, M. A., of Trinity college, Cambridge.

Mr. W. H. Caldwell of Cambridge, who has spent some time in Australia for the purpose of obtaining the material required for investigating the embryology of marsupials, monotremes, and *Ceratodus*, exhibited some of the results of his work at the recent Royal society *soirée*. It will be remembered that a telegram was sent to the Montreal meeting of the British association to announce his discovery of the fact that the eggs laid by the monotreme mammals developed in a manner closely similar to those of the Reptilia. Series of these mammalian eggs were exhibited by Mr. Caldwell, some taken a few hours after fertilization, with others at various stages up to hatching, and likewise different stages of the young after hatching, up to five inches long. He also showed a complete series of eggs of *Ceratodus*, the air-breathing fish of Queensland, from the unsegmented egg up to hatching, together with stages of the young fish after hatching. All this material is of the highest value, and Mr. Caldwell's researches are sure to throw much light upon many obscure problems of vertebrate morphology. He will also be able to supply Prof. W. K. Parker with the specimens necessary for investigating the development of the skull in *Ceratodus*, *Echidna*, and many marsupials. W.

London, May 30.

NOTES AND NEWS.

THE first circular of the local committee at Buffalo, of the American association, announces that the meetings will be held in the recently enlarged high-school building. Reduced rates have been obtained over many of the railroads, most of which will allow a return ticket at one-third of the usual fare, upon certificate from the local secretary at Buffalo. The Chicago and north-

western railway system will return members attending the Buffalo meeting, from Chicago, at one-third of the regular fare, upon presenting at the Chicago ticket-office a certificate from the local secretary at Buffalo: hence members residing in the north-west must see that they are in possession of two certificates when the meeting adjourns, — one to be used in Buffalo, and the other in Chicago. The Western union telegraph company, with its usual courtesy, will place its lines and district telegraph system at the service of members. The Botanical club of Buffalo is arranging an excursion and reception for the Botanical club of the association, as is also the Entomological club of that city for the Entomological club of the association. The address of the local secretary is Dr. Julius Pohlman, Buffalo, N. Y.

— The Appalachian mountain club propose issuing advance sheets of the forthcoming White Mountain map on a scale of 1:50000 by tracing the work now done, lettering the tracing roughly, adding the streams approximately, and copying by the 'blue print' process. Two sheets, a northern and a southern, will together cover the most important areas. It is hoped to have them ready by the first of July, and the cost is not likely to exceed seventy-five cents per sheet. Members may thus obtain maps of the accurately located points (including nearly all marked summits), on which they may fill in the lesser details, and mark corrections of the streams. Artistic appearance will not be attempted for these sheets; but their practical value will lie in the large scale, which is twice (linear) that on which the finished map is to be published. A field-meeting will be held on the summit of Mount Washington from July 1 to 8. Papers may be expected from Profs. E. C. Pickering and N. S. Shaler, Dr. W. G. Farlow, Messrs. J. Rayner Edmonds, Rosewell B. Lawrence, and others. The papers will be arranged for stormy weather and the evenings.

— Yale college, induced by the success of the Columbia college school of political science, and by the work in progress at Johns Hopkins, Cornell, and the University of Michigan, is making special arrangements for courses in political and social science, to begin in the autumn. Professor Sumner is announced to lecture on finance and the science and art of politics in the history of the United States; Professor Farnam, on the principles of public finance; Professor Hadley, on railroad administration; Mr. Wheeler, on Roman law; Mr. Terry, on the doctrine of rights; Mr. Reynolds, on comparative constitutional law; Mr. H. C. White, on local government in the United States; and Mr.

E. G. Bourne, on a view of trade and industry in Europe in the middle ages.

—On Aug. 25 next, Prof. Edward Zeller of Berlin will celebrate the fiftieth anniversary of the attainment of his doctorate. The many old pupils and friends of the learned historian and philosopher intend to present him on this occasion with his picture or bust, as a slight mark of their appreciation of his services to the cause of human knowledge. The movement was started in Berlin by some of Professor Zeller's associates, and the original announcement of their intention is signed by Bonitz, Dilthey, Eucken, Erdmann, Kuno Fischer, Helmholtz, Kronecker, Mommsen, Max Müller, Von Sybel, and many others. The names of all those who contribute to the fund will be communicated to Professor Zeller, and it is hoped that America will be well represented. Contributions may be sent to Prof. T. G. Schurmann, 15 West 57th Street, New York City, or to Prof. Nicholas Murray Butler, Columbia college.

—M. Ch. Bouchard has recently supplemented his observations on the toxicity of urine by the following ones. The increase in the production and elimination of the poison begins immediately after rising, and commences to diminish at about the middle of the waking period. Abstinence from liquids increases the toxicity, owing to the superabundance of incompletely oxidized matters excreted. Severe muscular labor notably, sometimes to the extent of nearly one-half, diminishes the toxicity, not only in the waking state, but also in the succeeding period of sleep. Compressed air diminishes immediately and markedly the toxicity, to be more largely increased afterward.

—Recent examinations of the bottom of the Lake of Constance and of Lake Geneva by Hörnlimann have brought out the interesting fact that the Rhine and Rhone rivers have excavated deep channels for long distances. The current of the Rhine can be followed for two kilometres, at a depth of one hundred and twenty-five metres below the surface of the water; while that of the Rhone has been traced more than six kilometres from the mouth, at a depth of between two hundred and two hundred and fifty metres.

—The production of gold in the gold-fields of the Australian colonies during 1885 reached in value £5,831,468. The total amount from the year of its discovery to 1886 is 79,194,094 ounces, valued at £310,865,718. There has been a considerable decrease in production during late years.

—The natural-history section of the Imperial Russian geographical society has decided to send an expedition, during the present year, into cen-

tral Asia, to explore the region of Khan Tengri, which has never been visited by European travelers.

—The statement in *Science* (vii. No. 174) that Prof. C. U. Shepard presented his cabinets to Amherst college was not strictly accurate. In accordance with an agreement of long standing, the college purchased his collections, and paid forty thousand dollars for them.

—Lieutenant Greely, the arctic explorer, who is entitled to his promotion to a captaincy in the U. S. cavalry in consequence of the retirement of General Sturgis, is not likely to be appointed to the vacancy in the adjutant-general's department, and it is possible he will not be promoted at all on the active list, for the reason that he has declared himself, undoubtedly with justification, unable to render active service. The generous thing for congress to do is to provide a place on the retired list, with ample rank, for Lieutenant Greely, in honor of his services and sufferings in the arctic regions.

—The new scientific building of Smith college, Northampton, Mass., will be dedicated Tuesday, June 22. The address will be by Prof. J. Peter Lesley.

—The extreme delicacy of the sense of smell in man has been shown by a series of experiments by Messrs. Fischer and Penzoldt. In an empty room of 230 cubic metres capacity, and tightly closed, a small quantity of the substance to be detected was thoroughly mixed with the air, and the observer then admitted. Among different substances it was found that the smallest amount recognizable was .01 of a milligram of mercaptan. This quantity diffused through the room sufficed to make its distinctive character appreciable in the small volume of air coming in contact with the nerves of the nose, from which it was estimated that the 1:460,000,000 part of a milligram of this substance was recognizable. Hitherto the spectro-scope has been considered the most delicate of all means of analysis, indicating less than the millionth part of a milligram of sodium; but the sense of smell, in the case of mercaptan at least, is seen to be at least two hundred times more delicate.

—Prof. S. F. Baird, U.S. commissioner of fish and fisheries, has recently received from the Department of fish-culture of the lower Seine, France, a gold medal as an acknowledgment for some valuable sendings of fish ova. The medal was designed by Oudine. On the obverse is represented a female head bound with a chaplet of cereals. Legend: 'Republique française.' On

the reverse is inscribed "M. Spencer F. Baird, United States commissioner of fish and fisheries," and the legend "Département de la Seine-Inférieure. La commission de pisciculture. 30 Novembre, 1885." The medal is about the size of a double eagle. It will be placed on exhibition in the north hall of the national museum.

— M. Charpentier, in a late session of the French academy, called attention to the following visual illusion: after a small, feebly illuminated object has been attentively viewed for some time in complete darkness, it will often appear to move in some determined direction in the field of vision, at a speed varying from two to three degrees per second, and sometimes through a distance subtended by an angle of thirty degrees or more. M. Charpentier states that this illusion occurs in the fixed eye observing a fixed point, but it is doubtful whether he is correct. *Muscae volitantes*, or floating spots due to impoverished blood or disease, have a like tendency in the closed eye, when attention is directed to them, of moving off in some determined direction, apparently as if floating upon the vision; but a finger placed upon the eyeball will at once detect that the spots are fixed upon the retina, while it is the eye itself that moves.

— A recent examination of the employees of certain French railroads for color-blindness, made in compliance with the instructions of the minister of public works, resulted in the detection of only two persons who were totally color-blind among 11,173. Three could not distinguish red, six green; eighteen showed a confusion in distinguishing between green and red, fifteen a like confusion between blue and gray; and fifty-two had a feeble sense of colors in general. These results show that the danger arising from color-blindness, on the French railroads at least, is almost *nil*. As is seen, not more than two per cent of the employees had imperfect sight, so far as colors in general were concerned, and not more than a half of one per cent were troubled with color-blindness in any way.

— During the year 1885 there were 155,177 German emigrants from the ports of Hamburg, Bremen, and Stettin, a decrease of over 40,000 from the preceding year. Of this number, 148,839 were immigrants to the United States.

— The coast-survey changes since our last issue are as follows: the party in charge of Assistant F. W. Perkins has returned from the south coast of Louisiana. The latter has gone to his home to work up the results of the trip; Captain Vinal has finished the gap on the west coast of Florida

in Hernando county (this completes the ocean shore-line of that coast, except a small strip near the Thousand Islands); Assistant Pratt, who is on the north-west Pacific coast, reports the government telegraph-line from Tatoosh Island to Port Angeles, Washington Territory, as so badly grounded that it is impossible to exchange time-signals for longitude over it.

— The Zuni maiden Wa-Wah, who has been in Washington as the guest of Mrs. James Stephenson for several months, is now engaged in weaving a blanket in the national museum, on the loom procured by that institution from the Zuni Indians. The loom, with the blanket upon it, will be placed in a case in the museum, together with photographs of Wa-Wah at work upon it, which will illustrate the mode of weaving employed by the Zunis. Wa-Wah is well versed in all the mysteries of the Zuni religion and the customs of her people, and has given Mrs. Stephenson and the museum authorities much valuable information. She took great interest in the model of the town of Zuni at the museum, and gave testimony of its accuracy by pointing out her own house. She will go back to her home in the Zuni country with the geological-survey party, who will visit that region next month.

— M. Tourette has recently published certain results of observations on the gait in walking, in health and in various pathological states, which are of interest. The average full or double normal step he finds in the adult man to be sixty-three centimetres; in woman, fifty centimetres; in both sexes the right step is a little longer than the left. The average separation of the feet, or the base of support, in man in walking, is from eleven to twelve centimetres; in woman, twelve to thirteen; in both sexes the lateral distance being one centimetre greater on the left side. The sum of the divergence between the axes of the feet and the axis of direction is, in man, thirty-one or thirty-two degrees, the angle being about one degree greater on the right side; in woman, thirty or thirty-one degrees, with one or two degrees greater divergence. In one of the pathological types occurring in locomotor ataxia, in paralysis agitans, etc., the step is smaller, and the distance between the feet as well as the angle between them is larger, than normal. Another type, seen in diseases of the spinal cord, hemorrhages of the cerebellum, and in vertigo, shows a zigzag manner of walking. The step may be either short or long; in either case the footprints are confused and indistinct, and deviate from the line of walking. Other differences have been wrought out. Perhaps the most unexpected

result was that the pathological step is more regular than the normal in all the points above noticed. In other words, in the normal walk it is the man himself who is walking, and his natural variations appear: in the other the disease does the walking, and the step is marked by the constant symptoms of his malady.

—Advices just received from Mr. William T. Hornaday, who was sent out by the national museum in search of buffalo, are to the effect that he has secured two antelopes; he has also sent to the museum three complete skeletons of old bull-buffaloes, and two skulls.

—The *Iron trade review* estimates that the quantity of domestic iron ore used in the blast-furnaces, rolling-mills, and forges of the United States in 1885 was 7,600,000 gross tons.

—Anatomists were considerably startled some time ago to learn that Professor Hamilton had discovered that the corpus callosum was not a commissural structure at all, but represented the decussation of fibres on their way from the cortex to lower parts. Almost every thing has been doubted in the anatomy of the brain, but the corpus callosum has always been regarded as a system of fibres whose connections and functions were rather definitely known. In a recent article (*Brain*, April, 1886), Dr. Beevor shows conclusively that our faith in the corpus callosum may remain undisturbed. The sections figured in his plate distinctly represent the fibres of the corpus callosum intersecting, and in no way joined with the fibres of the internal and external capsules. He answers Professor Hamilton's morphological argument that some animals exist without a corpus callosum by pointing out that in those (marsupials, for instance) the anterior commissure becomes proportionately developed. Dr. Beevor concludes then that the current view of the connections of corpus callosum and of the internal capsule are perfectly correct.

—That frogs have a formidable enemy in the common mouse is evidenced by the following. A correspondent of *Nature*, Mr. W. August Carter of South Norwood, states that he observed, a short time since, several mice pursuing some frogs in a shed which was overrun with these reptiles. The alacrity of the latter, however, rendered the attacks of the mice futile for a considerable period. Again and again the frogs escaped from the clutches of their foes, but only to be recaptured, severely shaken, and bitten. The energy put forth by these reptiles was so great that they actually swayed their captors to and fro in their efforts to wrest themselves from their grasp. At

length the wounds inflicted upon them rendered the frogs incapable of further resistance, and they were easily overpowered by the mice, which devoured a certain part of them.

—In 'Flowers, fruits, and leaves,' by Sir John Lubbock, Bart. (*Macmillan*), we have a popular, readable, and withal scientific account of many of the phenomena of fertilization of flowers, of the structure and varieties of seeds, and of many of the endlessly varied forms of leaves with which vegetation is covered. The first two chapters, on flowers, are a reprint, with some emendations and additions, from a previous volume by the distinguished author, and deal principally with the modes of fertilization, showing how, in many cases, appropriate insects are enticed into doing this important work, while other insects, not adapted to the work, are repelled or excluded from access to the flower. The next two chapters treat of fruits and seeds, and of their development and protection, and the modes of dispersion adapted to the habits and habitats of the plants in which they originate; while the last two chapters, on leaves and the varieties in their forms and arrangements, abound with suggestions of possible or probable causes determining the character of leaves and the diversities found within generic limits, and often even upon the same individual plant, according to age or size, as well as, on the other hand, the striking resemblances found among plants of widely different natural orders. The book is well calculated to awaken and foster in young people a love of nature, and to direct their attention to what is going on around them. It gives, also, an excellent idea of how many facts in the economy and ornamentation of plant-life can be rationally explained, without reference to the taste or wants of man, but solely by the 'survival of the fittest' in the struggle for existence.

—It is fortunate for those who need the valuable tables, the first instalment of which Professor Carnelly has just issued ('Melting and boiling point tables,' vol. i., London, *Harrison & sons*, 1885), that one so admirably adapted to the task should have been willing to devote eight years of almost continuous work to the compilation of a mass of material amounting to 50,000 data. The entire scheme comprises the presentation of all known data concerning the melting and boiling points of the elements, inorganic and organic compounds, and much miscellaneous information beside. The volume now before the public contains nineteen thousand data, and treats of the elements, inorganic compounds, and such organic compounds as contain not more than three elements. The second volume will include the remainder.

It is the aim of the author to state as fully as may be the constitution of every substance concerning which any thing is said, and original sources of information are indicated when known. For the convenience of readers who do not have access to large libraries, reference is also made to such related matter as may be found in Watt's 'Dictionary of chemistry,' or in the Journal of the Chemical society in London. The system of arrangement is simple, and the material accessible. The work, far more complete and convenient than any thing of its scope previously attempted, is a monument of patient industry intelligently applied.

—The wealth and thoroughness of information contained in Dr. O. Stoll's book on Guatemala (*Guatemala*, Leipzig, *Brockhaus*, 1886, 8°) shows at sight that the author is not one of the common travellers trying to perpetuate the memory of their sights in foreign countries. Stoll's main purpose in expatriating himself for five years to practise medicine in a land like that, was the thorough study of the aborigines. This enabled him to acquaint himself fully with the history, customs, and habits of the Indians, Ladinos, and whites in the western part of the country, where he resided. The results of his studies of the Indian antiquities and languages he published in a previous work, reserving for his 'Guatemala' the recital of his travels, which, from Guatemala City, extended over the east and south also, the political history, statistics, mode of life of the inhabitants, and general remarks upon the country. The numerous shortcomings and barbaric customs of the population do not excite in the writer a spirit of rancor, implacable hatred, or justifiable irony; for in most instances he simply presents to the reader, in frank and unmistakable terms, what he has seen and heard, and then leaves it to him to judge for himself. The tyrannic mode of ruling inaugurated by Barrios, the late president, forms a chapter too interesting to be skipped over.

LETTERS TO THE EDITOR.

**. Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Barometer exposure.

MR. H. HELM CLAYTON's interesting letter on the above topic (*Science*, vol. vii. p. 484) is not quite so satisfactory as his previous communication on thermometer exposures. He seems to think that "the facts all suggest that the wind, in blowing by at right angles to the cracks and crevices in the building, produces a mechanical effect, which tends to draw the air out of the building, and decrease the pressure inside."

Until it is incontestably established by observation that such fluctuations in the height of the barometer as he cites are peculiar to indoor barographs, it seems to me quite premature to ascribe them to the rarefaction of the air within the building. It certainly would be more satisfactory to the physicist, had Mr. Clayton made comparisons of the simultaneous indications of indoor and outdoor barographs. The observed facts are, that fluctuations of wind-velocity correspond with fluctuations of air-pressure. In some cases it may be difficult to decide which is cause, and which is effect. Certainly, in ordinary cases, the alteration of air-pressure is the cause, and wind is the effect. But if, in certain cases, it can be shown that indoor barometers are differently affected from outdoor ones, there would be rational grounds for reversing the usual relation of cause and effect. If such is actually the case, it certainly is an important item in barometric records.

JOHN LECONTE.

Berkeley, Cal., June 8.

Amblystoma and Gordius.

Recently a fine specimen of *Amblystoma mavortium*, presented me by Professor Sedgwick, was seen to be greatly distressed in its left fore-arm. The arm was swollen to its utmost; and, holding it out at right angles to the body, the 'salamander' seemed quite unable to use either arm or fingers. Enlargement of a small pore, in a prominence near the base of the little finger, behind the carpals, disclosed the cause of the trouble in a robust hair-worm a little less than five inches in length and nearly one-twentieth of an inch in diameter. Posteriorly two-thirds of the worm's body was of a light pink or flesh color; in front of this it was darker, except about three-quarters of an inch at the head, where it was almost white. The worm was coiled among the muscles of the fore-arm, and did not appear to have wrought them any injury, the member in a few days being as useful as its fellow.

Submitted to Dr. Fewkes, the parasite was pronounced an undetermined species of *Gordius*.

S. GARMAN.

Mus. comp. zool., June 10.

Penetrating-power of arrows.

I notice in *Science* for June 11 a short letter concerning the penetrating-force of arrows.

I have made the following experiment with a Chinese bow and Japanese arrows: length of bow unstrung 5 feet 11 inches; length of string 5 feet 8 inches; length of arrow 35 inches, weight of same 2½ ounces; height of feathers ¾ of an inch, length of same 4 inches.

The bow has a strength of 110 pounds when the string is pulled back 34 inches: it is made of whalebone and bamboo cut in long strips and glued together.

At 50 yards the entire arrow passes through an inch plank of clear pine wood. At the same distance, with oak of the same thickness instead of pine, the board is penetrated by the head of the arrow, but the shaft is shattered to small pieces. With a live pigeon at 20 yards, hit anywhere, the entire arrow passes through intact.

L. O. KELLOGG.

Oswego, N.Y., June 12.

SCIENCE.—SUPPLEMENT.

FRIDAY, JUNE 18, 1886.

HOW TO TEACH GEOGRAPHY.

IF American teachers of geography and history could know and appreciate how those subjects are taught in the best schools, and in fact generally throughout Germany, Austria, and France, they would hardly be able to recognize the fact that large and interested classes were in those countries deriving keen intellectual enjoyment, and also acquiring sound and lasting knowledge from and of two subjects which in our primary and intermediate schools are, as a rule, matters of weary memorizing and mechanical drudgery. To teach is something that most of our teachers sadly need to be taught; and of geography this is perhaps unusually true. The usual method in this country is to compel a child of from seven to twelve years to first learn an abstract definition of geography; then follow some erudite sections as to the distribution of land and water on the globe, races of men, climate, and so forth, all stated in technical language that might well appal some older persons, to say nothing of child-minds, to whom the subject is new and utterly strange. After several pages of this material have been carefully stored away in the wholly unappreciative memory, a map is introduced, and the study of geography proceeds with the learning of the names of countries, rivers, mountain-chains, towns, and other unmanageable details, all of which are treated as if they had no connection whatever with one another. In a year or two geography is 'finished,' and the process of forgetting much of it begins. This barbarous, useless, and unscientific method of teaching (it may be so called by courtesy) geography is not confined to this country: it is the method usually followed in England also: and a paper on the subject, read by R. Elliot Steel, F.R.G.S., before the College of preceptors in London, and reported at some length in the *Educational times* for May, is quite as deserving of attention here as in England. Mr. Steel summarizes the abuses and deficiencies of the present system of teaching geography under the following heads: 1°. In maps, ignorance of scale, and failure in remembering the general outlines of a country and its principal physical features, in consequence of the use of maps crammed with details, and unsuitable for

teaching-purposes; 2°. More than any thing, ignorance of physical geography, including the simplest laws of the inorganic world; 3°. Total neglect of history; 4°. Ignorance of the commercial aspects of a country.

The fundamental cause of all these shortcomings is the fact that geography is not taught as a unity in any of the universities, and therefore the vast majority of the text-books are written by book-makers, and not by ardent students and teachers of the subject. Thus, the school-atlas is a clumsy, ill-constructed affair, generally designed to help adults find some obscure place or river, rather than to teach geography. The matter of scale is wholly overlooked; and the child sees no incongruity in asserting Spain to be as large as the United States, or Europe to equal Asia in size, for do not both occupy a full page of the book? This matter of scale is of primary importance, and cannot be taught abstractly. It is well to have the schoolroom supplied with a series of maps, all drawn to the same scale, say, 1: 10,000,000. But it is far better to teach the child experimentally. Let him measure the schoolroom in units (feet and inches) perfectly definite and well understood. Then let him draw a plan of the schoolroom on the blackboard, reduced to a scale, and then compare objects with this picture. Gradually the object delineated can be changed from the schoolhouse to the block, from the block to the village or city, from the city to the state; and so on. This will fairly fix in the beginner's mind the principles of map-drawing, and after that a map will cease to represent to him merely a page of the text-book.

At present we teach words and phrases, abstractions, instead of circumstances, natural laws, and material things. For example: what possible good can be derived from making a child learn from a book that a glacier is a river of ice, which descends the slopes of high mountains, till it finally melts in warmer regions or reaches the sea? Such knowledge as this would not even fit the pupil to read profitably so popular and untechnical a book as Tyndall's 'Hours of exercise in the Alps.' Should not instruction concerning glaciers rather be given somewhat as follows? to take some snow or pounded ice, to compress it into a hard, ice-like mass, to point out how, in a similar way, after a fall of snow, the upper layers compress by their weight the lower, and how ice thus becomes formed in the cavities and gulleys

of mountains above the snow-line; then to take a piece of ice, and, by means of a wire with weights attached, to show how the ice may be slowly cut, and how it will refreeze, and thus to illustrate the passage of the glacier along its bed; to show by illustrations, preferably photographs, the nature of the moraines, the final melting of the glacier, and the formation of the resulting river. In this way the pupil's knowledge of glaciers is real and permanent, and he is prepared to read of them, and of theories about them, with appreciative interest. And in the process some elementary facts of physics and mechanics, and the simpler laws of heat, have been learned.

Again: if a child draws a map himself, and locates, say, a hundred places on it, he will probably remember them all; while not ten per cent of them, if learned from an outline-map, would be retained. The influence of geography upon history is one of the most potent of facts to the trained scholar, and, although it admits of very elementary demonstration, it is almost invariably disregarded in teaching geography. Surely it could easily be taught that there is a connection between tropical climate and despotism, between temperate climate and freedom; that vast pastures have implied a feudal society of chiefs and dependents; that aristocracy is the natural constitution of a pastoral state; that the sea and the mountains have in many instances directed the current of civilization and of political development. Books like Huxley's 'Physiography,' Geikie's 'Elementary lessons in physical geography,' and Grove's 'Class-book of school geography,' should form part of the instruction of every pupil.

Finally, the connection between geography and various phases of political and commercial life should be pointed out. It should be shown why it is that various portions of a country have various pursuits, why manufacturing, mining, agriculture, the carrying trade, respectively, are carried on in certain sections and from certain centres. From this the transition is simple and evident to the lines of trade and commerce, — whence we receive our various imported goods and why, and what we export in exchange. Then, as a means of teaching concerning peoples and products, every school should contain a museum, that the pupils might see and handle the objects of which they have read and studied. In this way, and only in this way, can the study of geography be placed upon a scientific basis, and made the vehicle of practical knowledge instead of a task in committing dry details to memory. If our teachers are to do their part in this work, they must be shown how to do it, and trained to

do it. For this we must look, we hope not in vain, to our normal schools, training-classes, colleges, and universities.

THE OCCUPATIONS OF THE BRITISH PEOPLE.

THE London *Times* of May 21 has an interesting report of a paper read by Mr. Charles Booth before the Statistical society, on the occupations of the people of the United Kingdom, and on the changes that have occurred in the distribution of labor during the present century.

The *Times* says, "The inquiry is a difficult one, owing to the imperfections of the earlier returns, and the changes which have taken place in the mode of recording social phenomena. It was not until 1831 that any attempt at detailed classification of occupations was made, and even then it was of a limited and unsatisfactory kind. The next census showed some improvement; and at length, in 1851, the system was originated which still prevails, and under which the entire population is brought under enumeration and grouped into seventeen classes, with numerous sub-classes. But the system has suffered considerable modification from decade to decade since that date, and, in particular, large numbers have been transferred from one class to another; so that any thing like a trustworthy comparison of the details of successive decades becomes a matter of very great labor and difficulty. Mr. Booth has constructed tables in which these defects in the records are, as far as possible, remedied, and the figures for different periods reduced to common denominators. Some of the results will probably be found surprising by those who have not entered upon careful examination of their natural impressions."

Mr. Booth stated, that, as regarded England and Wales, between 1851 and 1881 the proportion of industrially employed women over fifteen, compared to the rest of the female population, had decreased continuously, but that the proportion of those otherwise employed — in domestic service, teaching, etc. — had increased in an equal degree year by year; so that the total employed one way or another remained practically constant. Having in a tabular form divided the whole population, taking the occupied and unoccupied together, he stated that all males over twenty were counted, for this purpose, with the occupied or self-supporting class, and the whole employed class might be divided as follows in the periods 1851, 1861, 1871, and 1881 respectively: all forms of industry (productive or distributive), 78.4, 77.2, 75.5, 74.2 per cent; public and professional service, 4.6, 5.3, 5.5, 5.6 per cent; domestic service, 13.3, 14.6, 15.8,

15.7 per cent ; property-owning (so returned), 2.5, 2, 2, 2.2 per cent ; and indefinite, 1.2, 0.9, 1.2, 2.3 per cent. The increase of 1 per cent in the indefinite class for 1881 was due to the transfer to this class of retired persons, who, in previous censuses, were returned under their former occupations ; but, at best, those tabulated under this head were a meaningless remainder, the result of accident or defects of enumeration. Similarly the class called property-owning was entirely delusive. It contained a few land-owners, house-owners, and others who might as reasonably be included with other employers of labor in the sections of industry, and it also included a good many independent women.

It is certain that during the thirty years in question the classes whose maintenance depended on the mere possession of property must have been largely augmented. It would further be seen that public and professional service, with domestic service, had gained what productive and distributive industry had lost, and that this movement had been progressive. With regard to domestic service, it was noteworthy that the increase was mainly in the women and girls, the indoor men-servants having decreased from 74,000 in 1851, to 56,000 in 1881, while the population had risen from 18,000,000 to 26,000,000, — a fact which would seem to indicate a greater diffusion of wealth, and also, perhaps, less ostentation of expenditure among the very rich.

In public service and the professions the percentage of persons occupied in administration, law, and medicine, had slightly decreased ; while police, amusement, and education had increased, education especially showing, as might be expected, a large addition in the last decade.

Coming to a detailed review of the industrial classes, he stated that the production of raw material employed a decreasing percentage. The English depend more on what they import, and less on what they find at home. The reduction, however, fell entirely on agriculture, as the percentage employed in fishing and mining had increased. For the three decades since 1851, those employed on the land had decreased at the rate of 3½, 11½, and 11 per cent respectively ; being 26 per cent for the thirty years, or, stated in numbers, 60,000, 196,000, and 163,000, which added up to 419,000, an enormous total. Against these losses, which were mostly in ordinary agricultural labor, must be set the equivalent of the increased use of machinery, before we could say that less energy was devoted to the cultivation of the soil now than thirty years ago. A new class connected with the application of science to agriculture had sprung into being, and its increasing

numbers pointed to a change of system, involving improvements, rather than neglect of any kind, as a cause of the decrease in the agricultural population. It seemed to be assumed by many that the reduction in the proportion of those who lived by agriculture, as compared to those who lived by other means, was not only an absolute evil, but necessarily the result of economic error of some kind, and England's land system was responsible. Such views he regarded as mistaken and misleading. His business, however, was to state the facts as given in the census returns ; and these showed us, that, in the last thirty years, England had changed from a population about half agricultural and half manufacturing, to one in which manufacture was double of agriculture, and we had no reason to suppose that the process of change in this direction was yet ended. This change had been accompanied by an enormous increase in the total population, so that altogether support had been found during this period in other ways than the tilling of the soil for a new population of 8,500,000 souls. Since the beginning of the present century we had had to find new means of support for no fewer than 17,000,000 people. In calling attention to and correcting certain statements, which had been made with regard to what was called the 'depopulation' of our rural districts, — statements made, he said, to support propositions of violent social change, — Mr. Booth stated that the exodus from rural or non-urban districts amounted to 605,000 instead of 2,000,000 (mentioned by Mr. Wallace in 'Bad times' as the decrease between 1871 and 1881 in the rural population), and that the influx into the towns was less, again, than the total exodus from the rural districts by reason of the loss by emigration, finally reducing Mr. Wallace's 2,000,000 to 441,000. The greatest influx into urban areas was into comparatively new places, while the next greatest movement was that into the country districts surrounding the present centres of population, and especially adjacent to the new urban districts.

Purely agricultural districts had lost population largely, but otherwise there had been all over the country a fair distribution of the increasing millions, and everywhere new occupations had been found. It was unfortunately impossible to trace the occupations, other than agriculture, of the non-urban population. The backbone of the industrial organism they were studying was building and manufacture, which he ventured to bracket as being alike the turning of raw materials into things serviceable ; and they found that this remained nearly constant, at 38 per cent of the employed population.

The industrial development of England since 1851, and her apparent position in 1881, might, on the whole, be regarded with satisfaction; nor could any changes since 1881 have seriously affected the result. The growth of the population of Scotland ($6\frac{1}{2}$, $9\frac{1}{2}$, and $11\frac{1}{2}$ per cent for the three decades) had been slower than that of England, and the proportions engaged in each main division of industry were somewhat different; but the points of similarity were much more noticeable than the points of difference.

If the picture given of the condition of agriculture in England and Scotland was gloomy, that of the whole condition of Ireland was much more so. The numbers employed in agriculture had decreased since 1841 by 858,000, out of a total of 1,844,000; and those who might, perhaps, be counted as supported by agriculture, by 2,500,000 out of 5,000,000. Nor was that all; for, these reductions being proportionately greater than those of the whole population, the percentage employed in or supported by agriculture had decreased, as well as the total numbers. The land in England and Scotland employed as many, and probably supported nearly as many, as it did in 1841; and meanwhile other productive industries supported the bulk of our great increase of population. In Ireland, on the other hand, not only did the land fail to support half of those it once in some fashion maintained, but other productive industries (e.g., building and manufacture) were even worse off, and, like agriculture, showed it both in numbers and percentage, those engaged in building and manufacture (taken together) being 10.9 less in percentage, as well as 626,000 fewer in number, than in 1841. It was when taken together that these facts appeared so serious as evidence of decadence. Nevertheless, the view was commonly held, that, in general well-being, Ireland had enormously improved since the famine. No evidence of this improvement was to be found in the occupation returns, which, on the contrary, pointed to a demoralization of industry likely to be the cause, as well as consequence, of poverty and waning trade, and certain to be the source of political discontent. He knew that figures might be, and were, drawn from bank deposits and other returns which seemed to tell a different story. He would not attempt to reconcile this conflict of evidence, as to do so would be beyond the scope of his paper.

The *Times*, continuing its comments, says, "Before drawing conclusions as to the amount of labor applied to the soil, we have to remember that much of the apparent loss is simply due to the substitution of machinery for human activity, and also that numbers of men now included in

the manufacturing class are, in fact, employed, though indirectly, in extracting food from the soil. A reaping-machine supersedes a great deal of rural labor, but its construction involves the labor of a great many miners and artisans. It is perfectly proper to include these in the manufacturing classes for statistical purposes; but it would be a wanton misuse of statistics to ignore the fact, when the supply of food is in question, that it is the growth of food which provides them with employment. Mr. Ruskin asserts for himself the right to rail at all substitution of machinery for human handicraft; but practical men who accept labor-saving machines in cotton-mills cannot consistently object to their introduction into corn and beef factories, however much they may lament the tendency of 'progress' to transfer men from the open air to confined workshops. It curiously illustrates the continual failure of statistics to overtake the changes occurring in the social organism, that the distinction, apparently so sound and simple, between agricultural and manufacturing industry, utterly breaks down upon examination. There may be an actual decrease in the amount of energy applied to the production of food; but statistics do not tell us what it is, because they fail to discriminate between real withdrawal of energy from agriculture and mere change in the methods of applying it."

MRS. SIDGWICK AND THE MEDIUMS.

THE May meeting of the London society for psychical research was the occasion of the presentation of a paper by Mrs. Henry Sidgwick, which has been looked forward to with interest. The title of the paper was "Results of a personal investigation into the physical phenomena of spiritualism, with some critical remarks on the evidence for the genuineness of such phenomena." By physical phenomena of spiritualism, Mrs. Sidgwick means those which, if correctly described, and not due to conscious or unconscious trickery, nor to hallucination on the part of the observers, exhibit the action of a force in the physical world which has been previously unknown. Such physical phenomena would include raps, movement of tables without contact, materializations, psychography, and so forth. The writer stated that her experience in spiritualism extended over a period of twelve years, and had been entirely inconclusive except in cases where the phenomena were proved to be due to the action of the medium. She had had *séances* with all the leading English mediums (including Dr. Slade), and in every case there was evidence pointing more or less directly to deception and conjuring. The first part

of the paper was concluded with a description of the kinds and methods of deception practised by a medium named Haxby.

Mrs. Sidgwick then went on to discuss the various causes of error. She did not believe that hallucination, i.e., perception without objective counterpart, which Von Hartmann suggests as the explanation of what is seen at *séances* of this kind, had occurred in her own experience; but illusion, meaning the misinterpretation of what is really perceived or the confusing of inference with observation, was very common. It was believed that this was often the case when friends and relations are recognized in the 'materialized' forms.

Moreover, in estimating evidence concerning *séances*, a wide margin must be left for conjuring of a more special kind, and also for mal-observation arising from other causes, such as the ignorance of the observer as to the precise phenomena and conditions to be expected. Mrs. Sidgwick said that two arguments against the reality of the physical phenomena of spiritualism gained in force every year: 1°, the absence of phenomena about which there could be no question as to conjuring raised; and, 2°, the fact that almost every medium who had been prominently before the public had been detected in fraud. Nevertheless, the writer felt that there was some evidence not to be neglected, and which made it a duty to seek for more; but she considered it a waste of time to seek it with professional mediums under the conditions imposed at present. It is probable that many of the conditions supposed to be necessary, and which complicate the investigations and increase their difficulty, are invented merely to facilitate trickery.

Mrs. Sidgwick's paper was candid and able, and dealt with evidence, not theories. It is one more example of the good work being done by the Society for psychical research in determining just what basis there is for the multitude of current beliefs concerning certain classes of psychical and semi-psychical phenomena. In this case the conclusions are negative—or, as was remarked in the discussion of the paper, positive—as to imposture.

THE EVOLUTION OF LANGUAGE.

THE present advanced condition of our knowledge of language reflects, as well perhaps as any other study, the advantages of the modern method of research. One marked feature of that method is the taking of a broad general point of view, from which almost any pertinent fact bears an interest and a meaning: it does not narrowly and pedantically say such and such is my domain;

what is outside does not concern me. The condition of logic about one hundred years ago shows what happens when the latter position is taken. A second feature of modern methods of study is the importance assigned to the evolution of things: we want to know not only how things are, but quite as well how they came to be so; only then do we say we understand them.

Both these methods have been applied to language. Language is considered from a broad biological point of view as the means of communication between the same or different animal species. Human speech is but the highest stage of a special development of one form of such a means of communication. We shall see below how it is related to more lowly forms of making one's self understood. Not only its evolution, but its devolution, its loss and impairment in disease, have been wrought out. This has led to the formulation of an important law, which tells us that the latest acquired and best organized is the first to drop out. Moreover, it has sifted out the separate moments in the acquisition of speech, by a comparison of cases in which one special function is lost, while all others remain intact. Its anatomical seat in the brain is localized with as much exactness as that of other less complex faculties. The purely philological study of language is certainly flourishing, and is making its way back into the remotest antiquity, when it seems almost to touch hands with the prehistoric man of the anthropologists.

A recent writer in *Kosmos* (Dr. Carl Francke) has presented a very readable account of the relation of human speech to that of other animals. Any thing is regarded as a language which serves as a means of communication: the system of signals (probably by use of the antennae) by which ants tell each other of a precious find is perhaps the most rudimentary type of language. When we ascend to mammals and birds, which have lungs and use them as men do, we find that the sounds thus uttered are variously affected by emotional states, and soon serve to express the presence of such emotions. The dog barks with joy, howls with pain, and pleads by whining. In this tendency of psychic states to express themselves by vocal utterances, we have the origin of speech; for they become real speech-sounds as soon as other animals appreciate their meaning. The next great step is taken when an animal utters a cry for the purpose of calling its mate, not as a half-reflex expression of its own condition. Young birds probably have not reached this stage, but dogs certainly have. A dog will bark before a closed door till some one opens it. Some animals post sentinels, which give a definite cry of

warning in case of danger. The further argument for the possession of a language-sense by mammals and birds, at least, is that they readily learn to respond to a name given them. To what extent that sense can be cultivated is shown in Sir John Lubbock's dog, which brings out a card with 'o-u-t' on it when he wants to take a walk. The close sympathy between man and the higher mammals depends upon the fact that they can mutually understand one another, can distinguish the tones of pleasure and approval from those of pain and censure. How much more difficult is it to establish a similar bond between man and a reptile, for instance! for here the scope of mutual understanding is very limited. So far, what may be called an interjectional language, that is, one composed of sounds directly expressive of accompanying emotions, has alone been spoken of. The human infant, and probably primitive man, made much use of such a language. But our present language is an intellectual, a thought language, which in some way must have been developed from the former. Before touching this rather speculative question, it will be well to consider a form of language still current, but not expressed by sounds; namely, the gesture-language. This is both the simpler and the more natural. It is possible only in animals with easily movable limbs, especially in mammals, as witness the prancing of a dog, the exposing of the canines, the purring of a cat, or pawing of a horse. The ape has a special facility in this direction, and uses its facial muscles as a means of expression. We use the gesture-language in nodding, beckoning, threatening, and so on. This language, like the spoken, is acquired by the child, but much sooner than the latter: it reaches its highest development in the less cultured tribes, while the spoken language is seen in its highest phases among the most civilized; it is more general and uniform than any spoken language, and is capable of considerable development, as is shown in the training of the deaf and dumb. All these circumstances suggest that the gesture-language is a rudimentary one, which now is on the decline, but which has had a considerable development in the past. Combining this fact with the high development of this faculty in the ape (which has almost no sound-language), we seem to be tending to the conclusion that the creature from which man developed in one direction, and the apes in another, possessed both a sound and a gesture language; that in man the gesture-language was developed at first, but was then superseded by the spoken speech, beginning probably with an interjectional vocabulary, while in the apes the gesture-language alone was developed.

A still higher stage in the evolution of human

language was made when the interjectional and the gesture languages fused, and formed a sound-gesture-language. One reason for this change was that the gestures appealed to the eye, whose limit of distinct vision is very circumscribed; while speech appeals to the ear, which can hear in all directions and at great distances. This may have been prompted, too, by another reason. When desiring to communicate in the gesture-language, one would first interject a cry to call attention to that desire, and then the message would be told in pantomime. Many tribes cannot fully express their meaning without accompanying gestures, and it is told of one tribe that its members cannot communicate in the dark. But certain sounds are in direct connection with gestures. When one wants to refer to the teeth, one would point to them with the tongue; the chief function of the teeth is eating, and the interjectional cry accompanying this gesture would be modified into the word for 'eating.' Evidently, then, dentals ought to be found in the words for 'eating' in various languages. Here are a few: Gothic, *itan*; Greek, *esthien*; Latin, *edere*; Tartar, *atarga*; Mongolian, *edeku*; Chinese, *tsidh*. Many words for 'teeth' contain these dentals: as, *dens* ('tooth'); Persian, *dendun*; and so on. The sound *l* in connection with tongue-gestures, the sound *st* in connection with words for keeping silence (i.e., sounds with the mouth as much closed as possible), and other similar cases, could be summed up. Another class of natural words, as has long been recognized, is due to imitation. We see how strong this imitative tendency is in apes, young children, and even certain species of birds. The names of animals are given by their characteristic sounds, cuckoos, etc. The buzzing of the bees, the whizzing of the wind, the murmuring brook, are other examples.

One further step must be taken to set language on its present developmental stage: the man who pictures unseen gods in woods and streams, who sees signs of their pleasure in the flight of birds or the direction of the wind, must further extend his creative imagination to form sounds that are to be connected with new things and new deeds. Here, then, would be great range for individual differences; and the beginning of the confusion that reigned at the Tower of Babel must probably be put back to the time when the interjectional and gesture languages were still in full vigor. Once started on such a course, it is not difficult to imagine that languages would multiply and become hopelessly different and strange to one another. This is the problem of the philologists.

A critic should be lenient when considering speculations of this nature. The picture is doubt-

lessly filled in with greater detail than the facts rigidly warrant, and colors and forms are restored when age has worn off almost all traces of their original appearance. Nevertheless, the suggestiveness of the general view is valuable, and, when a better interpretation of the facts comes to hand, the old one can be modified or discarded.

JOSEPH JASTROW.

DISTRIBUTION OF COLORS IN THE ANIMAL KINGDOM.

MR. L. CAMERANO has recently communicated the results of his investigations on the distribution of colors in the animal kingdom to the Academy of sciences at Turin. Colors, he says, in the frequency of their occurrence, range in the following order: brown, black, yellow, gray and white, red, green, blue, and violet, the last of which is the most rare. They are, however, variable for different groups of animal life. Among the vertebrates, black, brown, and gray are the most common; among the invertebrates, red and yellow; green occurs most frequently among the lower types—never, however, in mollusks; violet appears in all the groups; while white is distributed very irregularly, but most commonly among aquatic animals.

The colors of animals generally bear some relation to the medium or situation which they inhabit. Aquatic animals usually have the colors more uniform and less lively than do the terrestrial ones. Not seldom they exhibit a transparency, and, when of brilliant colors, they generally live among seaweed and other aquatic plants, very seldom on rocks or sandy bottom. Birds of quick and rapid flight are not generally bright-colored. Animals living in sandy or rocky places are less varied and less highly colored than those living in regions covered with vegetation. The author denies the assertion that there is a constant relation between animals and their food-habits. Carnivorous animals living among rich foliage and flowers are often brilliant and varied, while many fruit-eating species are modestly or obscurely colored. The more rich a group is in species, the more varied, in general, are its colors. Intensity of coloration is not in direct relation with the amount of light to which the animal is habitually exposed, but bears a more direct relation with the general development, being diminished by deficient nutrition or disease.

A dry climate renders colors more sombre, while a moist one makes them more lively or clearer. Altitude also exerts an influence upon colors: according to the author, in the higher regions the more brilliant forms are observed, but this view is hardly borne out by facts in the animal king-

dom, though vegetation may perhaps conform to it. Species of the lower groups inhabiting islands are more often sombre in color than allied species from the continents. Different regions also modify in different ways the predominating colors. In the arctic regions, white, gray, black, and yellow predominate; in Ethiopia, yellow and brown; in India, the different shades of yellow; in the tropics, green and yellow; in Australia, sombre colors, and especially black. Throughout the animal kingdom, animals of large size are generally less varied, or more monotonous, in coloration, than smaller individuals of the same groups. In most animals the more brilliantly colored or spotted portions of the body are the most exposed ones: this is especially the case in insects.

A NEW ENGLISH DICTIONARY.

THE great English dictionary of the Philological society originated in suggestions made in 1857 by Dean (now Archbishop) Trench. Though a great mass of material was collected and many eminent men lent their aid to the undertaking, yet in consequence of the death of the first general editor, Mr. Herbert Coleridge, and other disturbing conditions, the work languished until the year 1878. At that time the directorship was assigned to Dr. Murray; and the delegates of the Clarendon press consented, under certain conditions, to bear the expense of printing and publishing the dictionary. Work was at once resumed with ardor. More than eight hundred volunteer readers undertook to collect additional quotations from specified books. In the United States the reading was in charge of Prof. F. A. March of Lafayette college, Easton, Penn., who has been indefatigable in his efforts to aid this great enterprise. In the course of three years a million additional quotations were furnished, making the total number about three million and a half, selected by about thirteen hundred readers from the works of more than five thousand authors of all periods. The general editor has been aided by a considerable number of sub-editors, and various specialists have furnished material in their respective departments. The apparatus, therefore, for the construction of this dictionary, is such as the world has never before seen. It is a combination of all the resources of the English-speaking world, conducted by the men who represent the broadest and most intelligent scientific knowledge.

The aim of the dictionary, the editor states, "is to furnish an adequate account of the meaning,

A new English dictionary on historical principles. Parts i. and ii. Ed. by JAMES A. H. MURRAY, LL.D. Oxford, Clarendon pr., 1884, 1885. f°.

origin, and history of English words now in general use, or known to have been in use at any time during the last seven hundred years. It endeavors, 1°, to show with regard to each individual word, when, how, in what shape, and with what signification, it became English; what development of form or meaning it has since received; which of its uses have in course of time become obsolete, and which still survive; what new uses have since arisen, by what processes, and when; 2°, to illustrate these facts by a series of quotations ranging from the first known occurrence of the word to the latest, or down to the present day, the word being thus made to exhibit its own history and meaning: and, 3°, to treat the etymology of each word on the basis of historical fact, and in accordance with the methods and results of modern philological science." The dictionary divides words and phrases into main words, subordinate words, and combinations. Main words are all single words, radical or derivative, and those compound words and phrases which are important enough to be treated in separate articles. Subordinate words include variant and obsolete forms of main words, and such words of bad form or doubtful existence as it seems proper to record. Combinations are usually dealt with under the main words which form their first element. The treatment of a main word comprises, first the identification, that is, the proper spelling and pronunciation, the grammatical designation, and the status, together with earlier spellings and the inflections; next the morphology or history of the form, that is, the derivation or etymology, the subsequent form-history, and miscellaneous facts respecting the history of the word; then the signification or sematology, obsolete senses being distinguished from those now in use; finally the illustrative quotations, which are arranged chronologically so as to give about one for each century. The scope of the dictionary is thus the largest possible, and it may properly be termed an encyclopaedia of English forms. The total number of words treated in the dictionary under the letter *A* is 15,123; namely, 12,183 main words, 1,112 combinations and compounds, and 1,828 subordinate words and forms, with synonyms. Of the 12,183 main words, 8,184 are current, 3,449 (28½ per cent) are marked as obsolete, and only 550 (4½ per cent) as foreign or imperfectly naturalized. As the letter *A* comprises in English dictionaries about a sixteenth of the whole alphabet, the editor estimates the total number of words to be dealt with in the dictionary as upwards of 240,000: the main articles being 195,000; the subordinate articles, 28,000; and the combinations or compounds requiring separate explanation, 18,000.

The way in which the work has so far been executed is entitled to all praise. On the etymological part, the best scholarship of the day has been called in, and all available material utilized. The arrangement of the significations has been made with great care; and how complicated and difficult a matter this is, may be seen from the articles *A*, *after*, *back*, *attend*, *arise*, and many others. The pronunciation also is very carefully indicated. Throughout the book, American peculiarities are noted. Part ii. goes down to the word *batten*.

It is impossible in a brief notice even to mention the words which have curious and entertaining histories. Nobody can fail to find the reading of this dictionary a most profitable occupation. Going over its articles is like entering a new country, or like the voyage of discovery which a great landed proprietor makes through his own domains. English words take us all over the world, and bring us into connection with almost all known languages; and the science of English etymology is a very wide and difficult one. It is surprising how many words there are whose origin is still unknown, such as *andiron* and *average*. The word *abthane* shows how men's imaginations can construct entirely baseless significations. One evil side of Dr. Johnson's influence is seen in the word *ache*. The queer paths taken by Arabic words show themselves in our *admiral*.

I do not find in the dictionary mention of the forms *anywheres* and *aprioric*. The definition of the word *apocrypha* is incomplete: it should include the apocryphal writings of the New Testament times. In the etymological notices of the words *Arab*, *Aramaean*, it should be stated that these are originally from the Arabic and Aramaic languages. Under *Araby* in the illustrative quotations we miss Milton's 'Araby the blest.' There is no reference to the possible Arabic origin of the flower name *anemone* as 'wounds of Naaman or Adonis.' The historical explanation of *barmecide* is not quite correct: the family was not one of 'princes ruling at Bagdad just before Haroun-Al-Raschid,' but a Persian family who occupied the position of vezirs under the caliphs, and it is surprising that the spelling *Raschid*, this unnecessary Germanism for *Rashid*, is retained.

C. H. TOY.

MYOPIA is said, on good evidence, to be increasing with great rapidity in Europe. During the past fifteen years the proportion of near-sighted students in the Polytechnic school of France has risen from thirty to fifty per cent, and eighty per cent of the students have to wear glasses.